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Ethylene Carbonate

CAS Number 96-49-1

USEPA HPV Challenge Program Submission

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Submitted by:

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I. Introduction

Huntsman Petrochemical Corporation has committed voluntarily to develop screening level human health effects, environmental fate and effects, and physicochemical test data for ethylene carbonate under the Environmental Protection Agency's High Production Volume Challenge Program.

Ethylene Carbonate (EC) is produced in a continuous process by the reaction of ethylene oxide (EO) with CO_2 and sold as different purity and color grades dependent on the supplier. EC may be used as a solvent for many polymers and resins, a plasticizer, an intermediate for pharmaceuticals, rubber chemicals, and textile finishing agents, and for hydroxyethylation reactions. Its use in these processes may results in environmental releases in waste streams. NIOSH (NOES Survey 1981-1983) statistically estimated that 4051 workers were potentially exposed to ethylene carbonate through inhalation or dermal contact at workplaces in the U.S.

Data Summary

	Data Available	Data Adequate	Testing recommended
Melting point	Yes	Yes	No
Boiling point	Yes	Yes	No
Vapor Pressure	Yes	Yes	No
Partition Coefficient	Yes	Yes	No
Water Solubility	Yes	Yes	No
Stability in Water	No	No	Yes
Transport	Yes	Yes	No
Photodegradation	Yes	Yes	No
Biodegradation	Yes	Yes	No
Acute Toxicity to Fish	Yes, metabolite	Yes	No
Acute Toxicity to Invert.	Yes	Yes	No
Acute Toxicity to aq.plants	Yes, metabolite	Yes	No
Acute Tox – oral	Yes	Yes	No
Acute Tox – dermal	Yes	Yes	No
Gene Tox *in vivo* – MN	Yes, metabolite	Yes	No
Gene Tox *in vitro* – Ames	Yes	Yes	No
Repeat dose- oral (90 day)	Yes	Yes	No
Reproductive toxicity	Yes, metabolite	Yes	No
Developmental tox	Yes	Yes	No

II. Test Plan and Rationale

A. Physical Chemical Data

The physical /chemical data for ethylene carbonate are found in standard reference works. The underlying data were not found, but additional testing is not justified. Transport between environmental compartments has been estimated using EPA software (EPIWIN Level III). Data on the stability of ethylene carbonate in water were not adequate. **Recommended testing:**

Stability in Water: OECD Test Guideline 111

Ethylene carbonate may hydrolyze under some conditions; therefore, its stability in water under various pH conditions should be determined.

B. ECOTOXICITY

Estimates of photodegradation based on reaction rates with hydroxyl radicals are available. Data on biodegradation were developed using current guidelines. Using OECD Method 301B, ethylene carbonate is readily biodegradable; more than 72% was degraded to CO_2 within 9 days and more than 90% after 28 days. Data on acute fish and toxicity to plants from ethylene carbonate were not found, but data on ethylene glycol were found. An acute toxicity study of ethylene carbonate was conducted according to OECD Guidelines, following GLP guidelines in daphnia.

Recommended ecotoxicity testing,: None

C. MAMMALIAN TOXICITY

Reliable acute toxicity tests are available on ethylene carbonate. Ethylene carbonate is practically nontoxic following acute oral exposure in a test that meets OECD and EPA test guidelines; the LD50 is >5000 mg/kg. The dermal LD50 is >2000 mg/kg, in a test that meets OECD and EPA test guidelines. No further testing is recommended.

Ethylene carbonate is rapidly metabolized to ethylene glycol. Following gavage administration to rats, ethylene carbonate is rapidly converted into ethylene glycol; the half-life for disappearance of ethylene carbonate from blood was 0.25 hours. As a result, the mammalian toxicity of ethylene carbonate is nearly identical to that of ethylene glycol for endpoints where both have been tested. For endpoints without data on

ethylene carbonate (reproduction and *in vivo* genotoxicity), data on ethylene glycol are used as a surrogate.

Ethylene carbonate was mixed in the diet of 26 male and 26 female Crl: CD(SD) rats for 18 months at concentrations of 25,000 ppm for males and females and 50,000 ppm for females; males were also fed 50,000 ppm for 42 weeks, and 40,000 ppm for 16 weeks. Survivors were observed to 24 months. Compound intake (mg/kg/day) was not reported, but is estimated to be approximately 250 and 500 mg/kg/day. No toxic effects were found in females, but increased mortality was seen in males at both dose levels. No high-dose males survived week 60 and only 10 low-dose males survived to week 78. Males had severe nephrotoxicity, characteristic of ethylene glycol toxicity.

In a chronic study of ethylene glycol, the principle metabolite of ethylene carbonate, male F344 rats had increased mortality from severe nephrotoxicity from dietary mixtures that resulted in daily compound intake of 1000 mg/kg/day. No effect was seen at 200 mg/kg/day. This study verifies that ethylene carbonate toxicity is represented by ethylene glycol toxicity.

The following *in vitro* genotoxicity tests were conducted on ethylene carbonate, without indications of genotoxicity: an Ames mutagenicity assay, an unscheduled DNA synthesis assay using rat heptaocytes, and a cell transformation assay using BALB/3T3 cells. No *in vivo* genotoxicity studies on ethylene carbonate were found; however, ethylene glycol has been tested and was negative in a rat dominant lethal assay.

Gavage administration of ethylene carbonate to pregnant rats days 6-15 of gestation resulted in systemic toxicity at doses of 3000 mg/kg/day, including post-dose salivation. The NOAEL for maternal toxicity was 1500 mg/kg/day. Similar to ethylene glycol, there were increased soft tissue (hydrocephalus, umbilical herniation, gastroschisis, cleft palate, misshapen and compressed stomach) and skeletal malformations at 3000 mg/kg/day, but not at 1500 mg/kg/day. No further developmental toxicity testing is recommended.

No studies of the effect of ethylene carbonate on reproduction are available; however, ethylene glycol was tested in a continuous breeding assay. Exposure in the drinking water at a dose of 1640 mg/kg/day for 98 days of continuous breeding resulted in fewer litters/fertile pair, fewer live pups/litter. Therefore, reproductive effects testing is not recommended.

Recommended Testing: None